

WHAT IS CLAIMED IS:

1. A method of producing a glass substrate for a mask blank, the method comprising:

a profile measuring step of measuring a convex/concave profile of a surface of the glass substrate for a mask blank;

a flatness control step of controlling a flatness of the surface of the glass substrate to a value not greater than a predetermined reference value by specifying the degree of convexity of a convex portion present on the surface of the glass substrate with reference to a result of measurement obtained in the profile measuring step and executing local machining upon the convex portion under a machining condition depending upon the degree of convexity; and

a non-contact polishing step of polishing, after the flatness control step, the surface of the glass substrate subjected to the local machining by the action of a machining liquid interposed between the surface of the glass substrate and a surface of a polishing tool without direct contact therebetween.

2. A method according to claim 1, wherein the non-contact polishing step is carried out by float polishing.

3. A method according to claim 1 or 2, wherein:

the machining liquid comprises:

an aqueous solution selected from water, an acidic aqueous solution, and an alkaline aqueous solution; or

a mixture of the aqueous solution and at least one kind of fine powder particles selected from colloidal silica, cerium oxide, zirconium oxide, and aluminum oxide.

4. A method according to any one of claims 1 through 3, wherein the local machining is carried out by plasma etching or a gas cluster ion beam.

5. A method according to any one of claims 1 through 4, wherein the reference value is not greater than $0.25\ \mu\text{m}$.

6. A method of producing a mask blank, the method comprising the steps of preparing the glass substrate obtained by the method according to any one of claims 1 to 5, and forming a thin film as a transferred pattern on the glass substrate.

7. A method of producing a transfer mask, the method comprising the steps of preparing the mask blank obtained by the method according to claim 6 and patterning the thin film of the mask blank to form a thin film pattern on the glass substrate.

8. A method of producing a semiconductor device, the method comprising the steps of preparing the transfer mask obtained by the method according to claim 7 and transferring the thin film pattern of the transfer mask onto a semiconductor substrate by lithography.